

Non-CO₂ Greenhouse Gases: High-GWP Gases

Source/Sectors: Semiconductor Sector

Technology: CVD cleaning emission reduction/C₃F₈ replacement (C.3.2)

Description of the Technology:

C₃F₈ is a potential drop-in replacement for C₂F₆ in some chemical vapor deposition clean and etch processes; its high utilization during etch may offset its high GWP (IEA, 2003; USEPA, 2001).

Although PFCs are not completely eliminated in these cases, overall emissions and potential impacts may be lower than in a scenario without the substitution. Therefore, replacing high GWP gases with environmentally benign substitutes for chemical vapor deposition clean and dielectric etch processes are the preferred option (USEPA, 2001).

Effectiveness: Good

Implementability: All fabrication facilities

Reliability: Although this option does not achieve the same emission reduction that NF₃ achieves, it is considerably feasible in cost performance. Thus, its excellent process performance as well as cost savings makes this alternative option attractive (US Climate Change, 2005; USEPA, 2001).

Maturity: Well developed

Environmental Benefits: Use of C₃F₈ will reduce high GWP emissions by 85% relative to the standard C₂F₆ process (USEPA, 2001).

Cost Effectiveness:

Technology	Lifetime (yrs)	MP (%)	RE (%)	TA (%)	Capital cost	Annual cost	Benefits
CVD cleaning emission reduction – C ₃ F ₈ replacement ¹	5	-	100	70-90	\$0.00	\$0.00	\$0.00

Note: MP: market penetration; RE: reduction efficiency; TA: technical applicability; costs are in year 2000 US\$/MT_{CO₂-Eq.}

1: IEA (2003) & USEPA (2001)

Industry Acceptance Level: C₃F₈ is reported in commercial applications at fabricating facilities owned by AMD, Motorola, and Texas Instruments (US Climate Change, 2005).

Limitations: This option is only applicable to control emissions from chamber cleaning processes; it accounts for approximately 70% of total fabrication emissions (IEA, 2003; USEPA, 2001).

Sources of Information:

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